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Gig-E Wi-Fi

Client: Mr. Emerich R. Winkler Jr.

BACKGROUND

- Many homes have rooms that suffer from slow internet speeds. Methods to improve performance using Wi-Fi extenders exist but often at the expense of lower connection speeds.
- Our solution with NCS Managed Services Inc. aims to solve this by routing internet traffic through powerlines.

IDEA

- The project was commissioned by Emerich R. Winkler Jr. of NCS Managed Services Inc.
- The goal is to design a prototype of a device that provides high internet speeds over powerlines with support for Ethernet, Fiber Optic, and Wi-Fi.

DESIGN DETAILS

- There are six submodules for the product. Overviews of each of the parts of the system are displayed to the right.
- These modules provide switching capability as well as physical interfaces for each of the required types of connectivity.

1. Powerline Transceiver
Enables sending of Ethernet packets through home powerlines using G.hn technology.

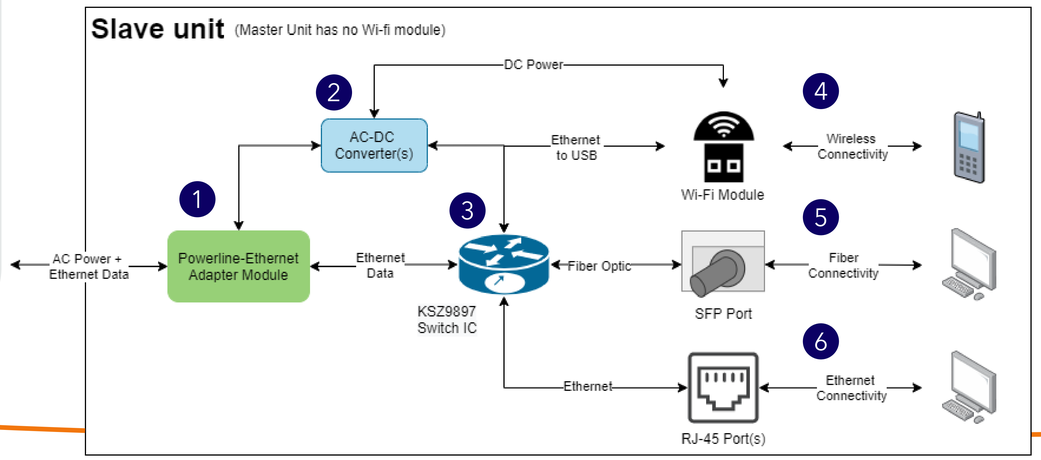
2. AC/DC Converters
Used to convert AC voltage to DC voltage in order to power the system electronics.

3. KSZ9897 Switch IC
Directs Ethernet traffic to the correct physical interface.

4. Wi-Fi Module
Allows system to communicate wirelessly with external devices.

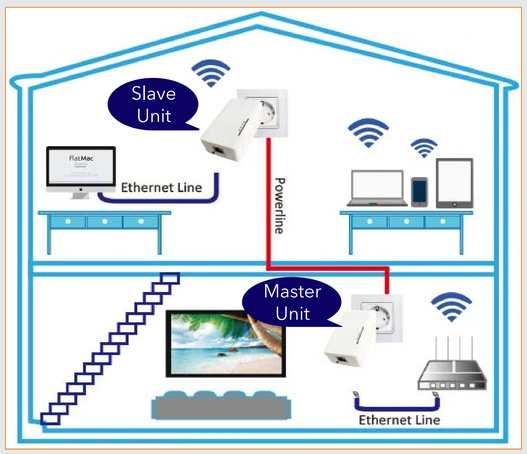
5. SFP Port
Used to interface with fiber optic cables.

6. RJ-45 Port(s)
Used to interface with standard Ethernet cables.



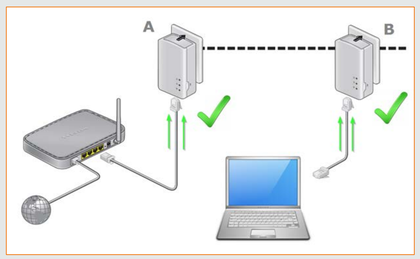
DELIVERABLES

- Device comprised of two wall-pluggable units/adapters:
  - Master unit: directly connected to the main router.
  - Slave unit: provides fast and reliable connectivity in desired room.
- Slave unit must support Ethernet, Fiber Optic, and Wi-Fi connectivity.
- Minimum of 330 Mbps internet speeds to surpass the competition. The closer to 1 Gbps speed the better.



TEST RESULTS

- Testing was done on the most similar product to our project on the market which was the Comtrend powerline adapter.
- The Comtrend powerline adapter was tested at different location of a typical household while running a speed test and the results can be found in the tables below with the maximum speeds shown in bold.
- The testing plan for our prototype will be done through ideal safe conditions to prevent any possible hazard.



Normal Tests	Download Speed [Mbps]	Upload Speed [Mbps]
Router Direct (Ethernet)	**577.72**	**895.28**
Same room (Wi-Fi)	337.92	218.61
Living Room (Wi-Fi)	420.65	184.44
Bedroom (Wi-Fi)	180.16	119.87

Comtrend Tests	Download Speed [Mbps]	Upload Speed [Mbps]
Same Circuit (Ethernet)	**333.2**	**308.83**
Living Room (Ethernet)	90.05	113.9
Living Room (Wi-Fi)	65.46	100.31
Bedroom (Ethernet)	109.23	126.31

CONCLUSION

- Tested the main competitor's products, Comtrend, and analyzed its working operation.
- Researched and critically reviewed existing patents.
- Chose the best parts after conducting extensive research then designed a high-level diagram of the slave unit.

FUTURE WORK

- Order electrical parts.
- Build a prototype based on the slave unit's schematic.
- Test the prototype and troubleshoot it, as necessary.
- Create documentation and instructions for the client.

REFERENCES

- Maxlinear G.hn Chips, https://www.maxlinear.com/
- Microchip Ethernet Switch IC, https://www.microchip.com/